

A QUANTITATIVE APPROACH TO IDENTIFICATION OF LATENT INDUSTRIAL CLUSTERS WITHIN THE REGIONAL PLANNING PROCESS

Assoc. Prof. Emil Papazov, PhD
UNWE – Sofia and University of Ruse
Ruse
Bulgaria

Assoc. Prof. Lyudmila Mihaylova, PhD
University of Ruse
Ruse
Bulgaria

SUMMARY

Industrial clusters are a set of interrelated firms that gain competitive advantages due to their geographical proximity. The regional economic policy strives to understand clusters and adapt programs to support their activities. To do so, latent clusters must be identified.

There are three general ways to cluster identification – a qualitative, a quantitative and a mixed approach. This paper reveals the main principles underlying the quantitative approach and discusses the ways of its proper implementation. The intention is to expand the analytical capacity of the regional developers to better formulate priorities, rendering an account to modern forms of business organization.

Keywords: industrial clusters, cluster analysis, regional planning

1. INTRODUCTION

The term "cluster" entered permanently into the business vocabulary in the 1980s due to the basic research of the Harvard professor Michael Porter. According to Porter, a cluster is “a geographically proximate group of interconnected companies, suppliers, service providers and associated institutions in a particular field, linked by externalities of various types [1]. This definition is accepted without reservations not only by a significant part of the Bulgarian researchers and experts on the topic, but also by different representatives of the economic policy [2]. When developing specific issues, however, the elements of a cluster are not always clearly understood. Therefore we will first try to clarify briefly the main ones.

2. KEY CHARACTERISTICS OF AN INDUSTRIAL CLUSTER

The first important point related to the understanding of clusters refers to its geographical specificity. In his studies Porter analyzes cluster formations in two aspects – a national and a regional one. The national coordinates of a cluster are important when conducting analyses from the point of view of a mega structure level like the EU or the world economy itself. The regional disaggregation seems more relevant for macro- and mesostructures. However, Porter doubts – even in the first mentioned case – whether the state as a whole is a pertinent reference system for analysis, since the conditions that underlie a competitive advantage are often located inside the country [3].

The second important point concerns the sectoral (or branch) affiliation of the companies which constitute a cluster. If the studied structure is dominated by companies from a

particular industry, the cluster is usually perceived as horizontal. If the companies belong to different industries, it is treated as vertical.

The third important aspect concerns the nature of connections between the companies in a cluster. Some of the relations are characterized as complementary, others – as technological. A complementary relationship usually goes hand in hand with horizontally arranged objects, while a technology relationship combines vertically stacked elements. The fourth point is related to the so-called "externalities". Externalities originate from shortcomings in the functioning of the market economy. They are offset or neutralized by the nation through the production and supply of public goods.

If the above-mentioned characteristics are properly combined, different types of clusters will be obtained. Among the most important and distinguishable combinations are [4]:

- In the first place, national – horizontal or vertical industrial alliances – with primarily complementary or mostly technological relationships, for which the externalities are offset by public goods offered by the government (in short: national clusters).
- In the second place, regional – horizontal or vertical industrial alliances – with primarily complementary or mostly technological relationships, for which the externalities are offset by public goods offered by the government (in short: mixed clusters).
- In the third place, regional – horizontal or vertical industrial alliances – with primarily complementary or mostly technological relationships, for which the externalities are offset by public goods offered by the regional authorities (in short: regional clusters).

As already mentioned, the first combination is of interest primarily to the mega economy. National clusters consist of sectors and activities in which the country is specialized in the spatial structure of a higher order (e.g. the EU). Their establishment in the global arena is the result of long-term efforts. Such entities act as "magnets" that attract most foreign strategic investors and large companies [5].

The second combination is interesting first and foremost for SMEs. It can occur in connection with the solution of a specific problem and can be triggered by a single private sector or collective (branch) initiative [6]. It can also result from a government intervention. If clusters of this type are realized with the decisive support of the government, they are considered to be created "from above". Typically, that they act on the basis of formally established structures, with due control mechanisms and administrative "cap". Their maintenance is provided by various sources, the main ones coming from government-sponsored projects, offered paid services or membership fees. Clusters of the mixed type are typical for countries with a specific form of public-private business organization, where the state plays a dominant role, and the businesses are required by law to join a nationwide employers' organization.

In countries where the public-private partnership is organized in a different manner (presence of more than one autonomous professional organization with a voluntary membership, regional autonomy of industrial chambers, etc.), the clustering activities are usually redirected to the third kind of clusters – the pure regional ones. A supportive role in this process plays the availability of financial decentralization for the local budget, i.e. higher the concentration of resources in the local communities.

In brief, the regional clusters have the following main characteristics: the initiative for their formation belongs to the regional communities; regional clusters normally attract organizations from various types, including universities and research centers, etc.; using this form of organization of the public-private activity does not always require the setting-up of formal structures ("caps"), the collecting of fees and the like; the identification of regional clusters is performed in the framework of the regional development planning.

In Bulgaria, despite the presence of certain conditions, pure regional clusters are rarely on the agenda of the regional policy. Among the most frequently emphasized reasons for the

negligible interest are the limited financial resources of the local authorities and the poor awareness of the potential of regional clusters to provide for sustainable development of a region.

In the most developed countries and communities clusters tend to represent the building blocks of the economy, following Porter's generalization that "specialization in clusters, not in industries per se, should lead to higher performance" [7]. Perceiving this idea and combining it with opportunities held out for the European perspective of Bulgaria will increase the interest of the local authorities towards regional clusters. This interest, in turn, will provoke the search for suitable methods for identification of latent clusters.

3. A METHOD FOR IDENTIFICATION OF LATENT CLUSTERS

A particular set of organizations can be recognized as regional cluster (mixed or pure), if most of the important participating elements are located in a geographic proximity and are interrelated. Not all networks of companies, however, are appropriate to be considered as clusters. A "sufficient" condition could be the presence in the entity of at least one relatively strong (concentrated, possessing enough critical mass to become a regional development factor), export-oriented (specialized) and comparatively successfully growing (well-performing) over time industry.

The strength, orientation and performance of an industry can be established with the help of different types of indicators (absolute, relative, and index). As regional systems typically have hierarchical character, an important role in the scientific research play comparisons related to the development of the one and the same objects in different spatial communities – studied and reference¹. In this case, it is reasonable to use index values.

The index calculation is usually preceded by a clarification of the issue concerning the most appropriate statistical population intended to be used. The latter should be sought among the indicators, provided by the official statistics, with a breakdown by economic sectors within a standard classification valid for at least two years² [8]. It is preferable to use a breakdown of a higher order. The reference year is usually chosen as the latest for which data are available, and the base year – an earlier one. It is important to have an adequate distance in time between the base and the reference year in order to "capture" the dynamics.

In the regional research practice, the most commonly used statistical population refers to the number of employees. Employees represent an adequate criterion not only because the information on them is relatively affordable, but also because of the lasting interest of the economic policy to the employment issues. However, the possibility of using other indicators (e.g. GDP; value added) should not be excluded, provided that they are available (and in the necessary breakdown) from official information sources [9].

The information submitted by the national statistics can be regrouped using the following table (see Table 1).

A strong regional industry has normally a higher concentration than the concentration of the same industry in the reference economy. As a measure of the degree of concentration the so-called location coefficient L_i , calculated for the reference year, is most frequently used [10]. For a single industry, the location coefficient is obtained by comparing the share of a sector in the local economy with the share of the same sector in the reference economy [11]:

$$L_i = \frac{e_i^{Y_n} / e^{Y_n}}{E_i^{Y_n} / E^{Y_n}} \quad (1)$$

¹ Reference areas are chosen from the same or higher hierarchical level. The latter is used predominantly. The preference is for the national economy as area to compare with.

² This is a required minimum to perform a comparative-static study.

If $L_i > 1$, the industry is considered concentrated (strong); otherwise, it is believed that it is unconcentrated (weak).

Table 1: Employees under labour contract by economic activity groupings (Average annual number)

NACE	Economic activity groupings	Region			Country		
		Y_0	Y_n	$e_i^{Y_n}/e_i^{Y_0}-1$	Y_0	Y_n	$E_i^{Y_n}/E_i^{Y_0}-1$
A	Agriculture, forestry and fishing						
⋮	⋮						
S	Other services						
Total		$e^{Y_0}=\sum e_i^{Y_0}$	$e^{Y_n}=\sum e_i^{Y_n}$	—	$E^{Y_0}=\sum E_i^{Y_0}$	$E^{Y_n}=\sum E_i^{Y_n}$	$E^{Y_n}/E^{Y_0}-1$

Note: The symbols used in the table should be read as follows: Y_0, Y_n – basic, resp. – reference year; e_i, e – number of employees in sector i , resp. – total employees in the territory of study; E_i, E – number of employees in sector i , respectively – total employees for reference territory; $e_i^{Y_n}/e_i^{Y_0}-1, E_i^{Y_n}/E_i^{Y_0}-1, E^{Y_n}/E^{Y_0}-1$ – growth rates.

Very often it is assumed that the high concentration of an industry in a region automatically leads to specialization (export orientation), as the production of a concentrated industry typically exceeds local needs. However, the truthfulness of this statement has to be verified. For example, the high concentration of a construction business in a region could be a direct consequence of a high natural or mechanical population growth and thus related to unmet housing needs. This conclusion could be backed with data showing an increase in the mortgage banking loans for the same period. In this case, it can be concluded with a great amount of confidence that the concentrated construction industry is designed exclusively for local needs and not for export orientation.

The performance evaluation of a local industry for a time period could be realized with the help of the so-called regional differential (r_i) after applying the following equation:

$$r_i^{Y_0, Y_n} = \frac{e_i^{Y_n}}{e_i^{Y_0}} - \frac{E_i^{Y_n}}{E_i^{Y_0}} \quad (2)$$

The regional differential reflects the shift of the shares of the studied and reference industry. The index is an integral part of a broader concept [12,13] called shift-share analysis that seeks to explain the reasons for the success or failure of a regional industry for a period in question. According to this concept, a part of the success or failure of a local industry is due to external impact of spatial communities of a higher rank (after the hierarchical nature of regional systems) and its expression is the movement of shares, reflecting changes in the level and structure of the reference economy. Another reason for a successful (unsuccessful) performance of a local industry could be the disclosed and utilized (undisclosed and unutilized) internal development capacity. An expression of such a potential is the regional differential, according to which a successfully developing industry in the research area over time is the industry that grows relatively faster (or decreases relatively slower) in comparison with the same industry of the reference spatial economy [14]. The results with the calculated location coefficients L_i and the regional differentials (r_i) can be summarized in a table with the following form (see Table 2).

The table's last column contains an assessment of the relative strength and comparative performance of the industries in the region. For this purpose, abbreviations (or a combination between them) typical for the SWOT analysis such as strengths (S), weakness (W), capabilities (O) and threats (T) could be used. The approach is justified, as $L_i > 1$ is consistent with an industry in a strong position, and $r_i > 0$ reflects the circumstance that the industry has used available opportunities for a successful development. Industries with results $L_i < 1$ and

$r_i < 0$ have the opposite – weak position combined with adverse influence of the internal and external factors of development on the industry of study.

Table 2: Evaluation of the strength and performance of the industries studied by a region

NACE	Economic activity groupings	L_i^{Yn}	$r_i^{Y0,Yn}$	Evaluation
A	Agriculture, forestry and fishing			S-O
:	...			S-T
:	...			W-O
S	Other services			W-T

After completing the assessment, the industries in the table are regrouped using the parameters entered in the last column. Thus, one can be better identify the industries that fit in the combinations SO, ST, WO and WT and the four quadrants outlined after them.

It is considered that candidates for latent clusters should be sought among industries within the quadrants S-O, i.e. among the most concentrated and well-performing businesses [15]. An additional check of export oriented sectors and subsectors will sort out those who are of local importance. As a result, candidates will be identified as meeting all the three criteria mentioned at the beginning of this section.

This methodology has been applied to investigate one of the leading Bulgarian economic regions – the Rousse district. The study on the detection of potential clusters refers to the period 2008-2011 and for this purpose statistical data on employees per industry (classification A31) have been processed. The national economy has been adopted as reference area.

From the compiled (after processing of raw data) Table 3 can be concluded that the industries CB, CI, CG, CF, CH, O, S and R fall in quadrant SO. Not all of them, however, should be considered as candidates for a latent cluster. For example, O and S possess relatively high employment, but this is probably due to the significant concentration of population in the region compared to the national average. In contrast, sector R ("Arts, entertainment and recreation") and those of the sub-sector "Manufacturing" should not be excluded.

Table 3: SWOT evaluation of Economic activity groupings – Ruse District, period 2008–2011

NACE	Economic activity groupings	L_i^{11}	$r_i^{08,11}$	Evaluation
CB	Manufacture of textiles, wearing apparel, leather and related products	2.3035	0.1082	S-O
CI	Manufacture of computer, electronic and optical products	2.1623	0.3094	S-O
CG	Manufacture of rubber and plast. products, and o non-metal. min. prod.	1.6103	0.8097	S-O
CF	Manufacture of pharmaceuticals, medic. chemical and botanical prod.	1.3568	1.9688	S-O
CH	Manufacture of basic metals and fabric. metal products, except machine.	1.1481	0.2179	S-O
O	Public administration and defence	1.0589	0.3078	S-O
S	Other services	1.0418	0.3045	S-O
R	Arts, entertainment and recreation	1.0389	0.0962	S-O
CL	Manufacture of transport equipment	2.1987	-0.0372	S-T
CE	Manufacture of chemicals and chemical products	2.1313	-0.3798	S-T
CM	Other manufact., and repair and installation of machinery and equipm.	1.7199	-0.1460	S-T
A	Agriculture, forestry and fishing	1.5592	-0.0596	S-T
CK	Manufacture of machinery and equipment n.e.c.	1.5115	-0.0775	S-T
H	Transportation and storage	1.2791	-0.0758	S-T
P	Education	0.9216	0.0425	W-O
I	Accommodation and Food service activities	0.8471	0.2238	W-O
CC	Manufacture of wood and paper products, and printing	0.8215	0.3082	W-O
F	Construction	0.8095	0.0589	W-O
L	Real estate activities	0.6018	0.0079	W-O
M	Other professional, scientific and technical activities	0.5109	0.0910	W-O

<i>Continued</i>				
NACE	Economic activity groupings	L_i^{11}	$r_i^{08,11}$	Evaluation
CD	Manufacture of coke, and refined petroleum products	1.1164	0.0000	W-T
Q	Human health services and social work activities	0.8858	-0.0077	W-T
CJ	Manufacture of electrical equipment	0.8703	-0.0519	W-T
G	Wholesale and retail trade, repair of motor vehicles and motorcycles	0.8689	-0.0758	W-T
D	Electricity, gas, steam and air-conditioning supply	0.7656	-0.0137	W-T
E	Water supply, sewerage, waste	0.6236	-0.1563	W-T
CA	Manufacture of food products, beverages and tobacco products	0.5977	-0.0065	W-T
K	Financial and insurance activities	0.5382	-0.0715	W-T
B	Mining and quarrying	0.3854	-0.5815	W-T
N	Administrative and support service activities	0.3785	-0.2309	W-T
J	Publishing, audio-visual and broadcasting activities	0.3176	-0.3647	W-T

Of particular interest are the good indicators of the sector R ("Arts, entertainment and recreation"). Ruse is an area known for its rich cultural traditions in music and theater. Every year the town hosts festivals that attract many visitors not only from other regions of the country but also from abroad. Therefore, the R sector should not be attributed mechanically to locally servicing industries. It probably represents the core of a "cultural" cluster – something that has escaped the notice of the economic policy of the region.

4. REFERENCES

- [1] Porter, M. (2003): The Economic Performance of Regions, *Regional Studies* 37(6–7), p. 562.
- [2] MIET. (2005): Natsionalna strategiya za razvitiye na klasterite, Sofiya, s.s. 6-7.
- [3] Porter, M.: Konkurentno predimstvo na natsiite, Klasika i stil, Sofiya, 2004, s. 212.
- [4] For a more detailed classification of clusters, see Papazov, E. (2008) Cluster-based strategies for regional and cross-border economic development, *International Conference "Cross Border Cooperation and Entrepreneurship Development"*, 02-04 July, Varna, 2008.
- [5] One of the newest Bulgarian publications on clusters presents an idea of creating a national cluster in the quickly developing automotive industry, building on the experience of two existing clusters in this field – a regional and an international one. For further details, see Pencheva, V., et. al. (2013) The Cluster Approach and RTD Potential of Bulgaria for Development of Automotive Industry, *International conference "An European Research Strategy for Intermodal Transport"(Intraregio project)*, Las Palmas de Gran Canarias (Spain), 17-18 April 2013.
- [6] Similar clusters have been a prerogative of the PHARE Program Pilot project for Introduction of a Cluster Approach and Establishment of a Pilot Cluster Model (BG2003/004-937.02.03), implemented by the MEET, BSMEPA and other departments in 2005-2006.
- [7] Porter, M. (2003): Op. cit., p. 562.
- [8] The present statistical classification of economic activities implemented by the EU countries (and Bulgaria) is called NACE. For further details, see www.nsi.bg (20 Apr. 2013).
- [9] Papazov, E. (2006): Tehniki za obektivizirane na SWOT-analiza na regionalnoto razvitiye, v-k *Ikonomicheski zivot*, br. 2, s. 9.
- [10] Klosterman, R. (1990): Community analysis and planning techniques. Rowman & Littlefield Publishers, p.p. 128-133.
- [11] Papazov, E. (2008): *Podhodi kam strategicheskia analiz pri planiraneto na mezoikonomicheski strukturi*, in: Strategicheski aspekti na upravljenieto na mezoikonomicheski strukturi, Ruse, p.p. 1-22.
- [12] For further details, see Shaffer, R., Deller S., Marcouiller, D. *Community Economics: Linking Theory and Practice*. Blackwell Publishing, 2nd ed., p.p. 76-77, 260.
- [13] Papazov, E. (2006): SWOT analiz na regionalnoto razvitiye. *Ikonomika*, Issue 1, p.p. 26-30.
- [14] Blakely, E., Bradshaw, T. (2002): *Planning local economic development: Theory and Practice*, 3rd ed., Sage Publications, p. 129.
- [15] Blakely, E., Bradshaw, T. (2002): Op. cit., p. 141.